

QIAOXIN N-Channel Super Trench Power MOSFET

Description

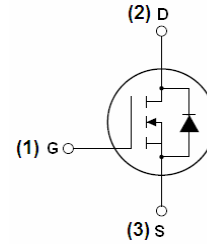
The VCRRP0178AF uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g . This device is ideal for high-frequency switching and synchronous rectification.

General Features

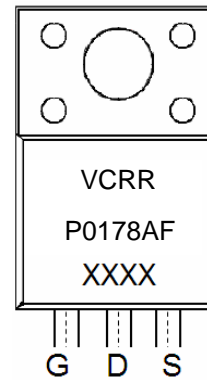
- $V_{DS} = 100V, I_D = 78A$
 $R_{DS(ON)} = 7.2m\Omega$ (typical) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 9.5m\Omega$ (typical) @ $V_{GS} = 4.5V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

Application

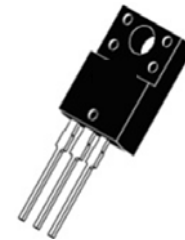
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



Schematic diagram



Marking and pin assignment



TO-220F top view

Package Marking and Ordering Information

Device Marking	Device	Device Package
VCRRP0178AF		TO-220F

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	100	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	78	A
Drain Current-Continuous($T_C = 100^\circ C$)	$I_D(100^\circ C)$	60	A
Pulsed Drain Current	I_{DM}	320	A
Maximum Power Dissipation	P_D	50	W
Derating factor		0.33	W/ $^\circ C$
Single pulse avalanche energy ^(Note 5)	E_{AS}	320	mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175	$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case ^(Note 2)	$R_{\theta JC}$	3	$^{\circ}C/W$
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Electrical Characteristics ($T_C=25^{\circ}C$ unless otherwise noted)

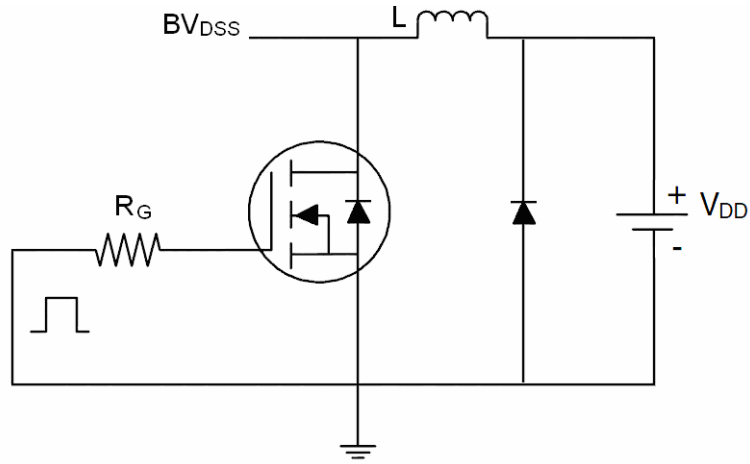
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	100		-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=100V, V_{GS}=0V$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.7	2.2	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=39A$	-	7.2	8.5	m Ω
		$V_{GS}=4.5V, I_D=39A$	-	9.5	12	m Ω
Forward Transconductance	g_{FS}	$V_{DS}=10V, I_D=39A$	40	-	-	S
Dynamic Characteristics ^(Note 4)						
Input Capacitance	C_{iss}	$V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$	-	4200	5480	PF
Output Capacitance	C_{oss}		-	354	425	PF
Reverse Transfer Capacitance	C_{rss}		-	23	30	PF
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=50V, I_D=39A$ $V_{GS}=10V, R_G=4.7\Omega$	-	15	-	nS
Turn-on Rise Time	t_r		-	10	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	41	-	nS
Turn-Off Fall Time	t_f		-	6	-	nS
Total Gate Charge	Q_g	$V_{DS}=50V, I_D=39A,$ $V_{GS}=10V$	-	65		nC
Gate-Source Charge	Q_{gs}		-	15.3		nC
Gate-Drain Charge	Q_{gd}		-	9		nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V_{SD}	$V_{GS}=0V, I_S=78A$	-		1.2	V
Diode Forward Current ^(Note 2)	I_S		-	-	78	A
Reverse Recovery Time	t_{rr}	$T_J = 25^{\circ}C, I_F = I_S$ $di/dt = 100A/\mu s$ ^(Note 3)	-	101		nS
Reverse Recovery Charge	Q_{rr}		-	193		nC

Notes:

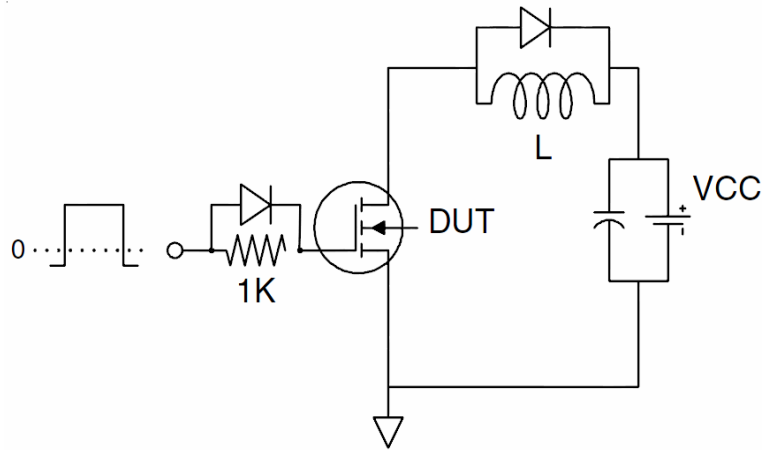
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition : $T_J=25^{\circ}C, V_{DD}=50V, V_G=10V, L=0.5mH, R_g=25\Omega$

Test Circuit

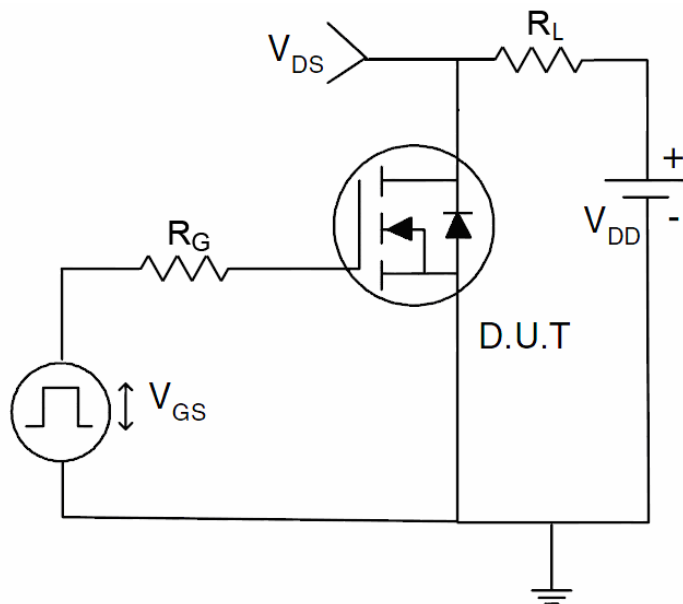
1) E_{AS} test Circuit



2) Gate charge test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics

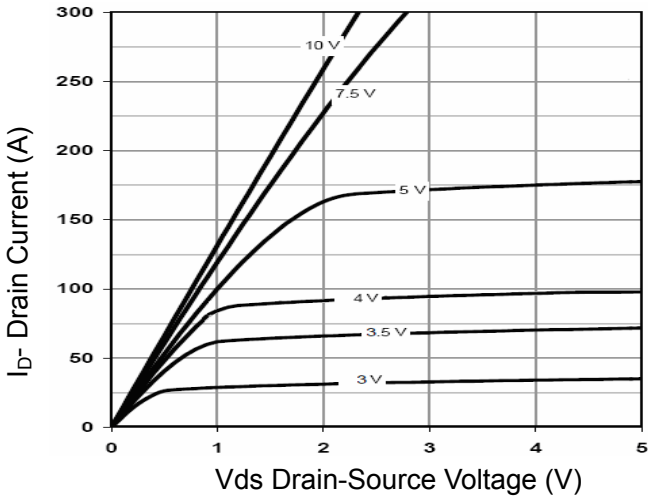


Figure 1 Output Characteristics

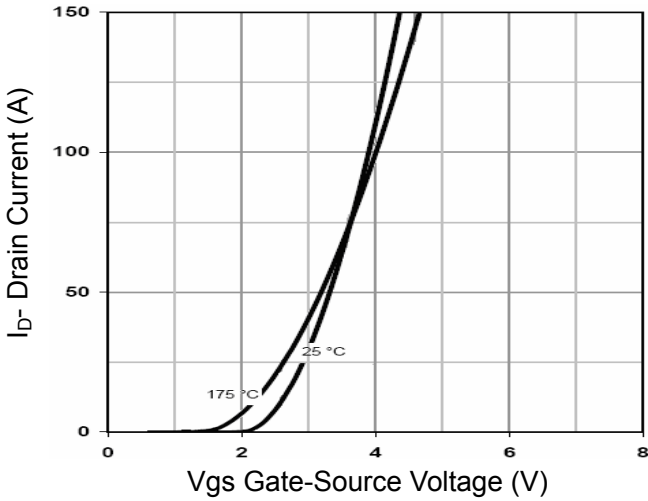


Figure 2 Transfer Characteristics

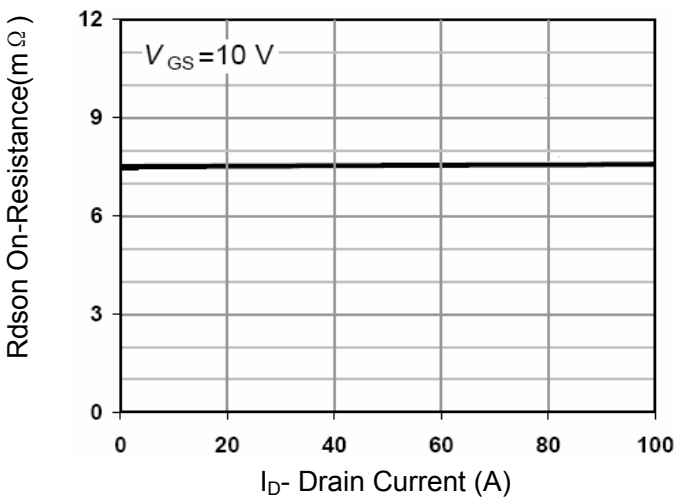


Figure 3 Rdson- Drain Current

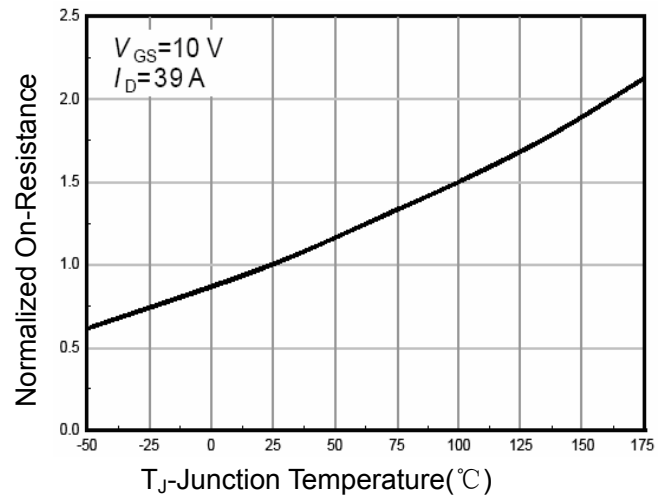


Figure 4 Rdson-Junction Temperature

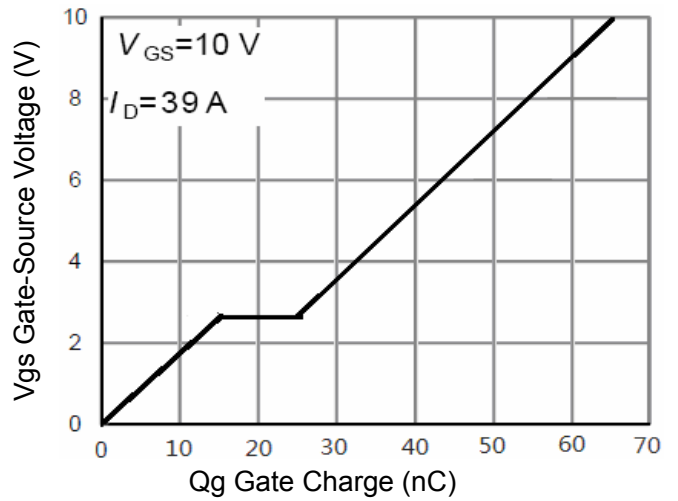


Figure 5 Gate Charge

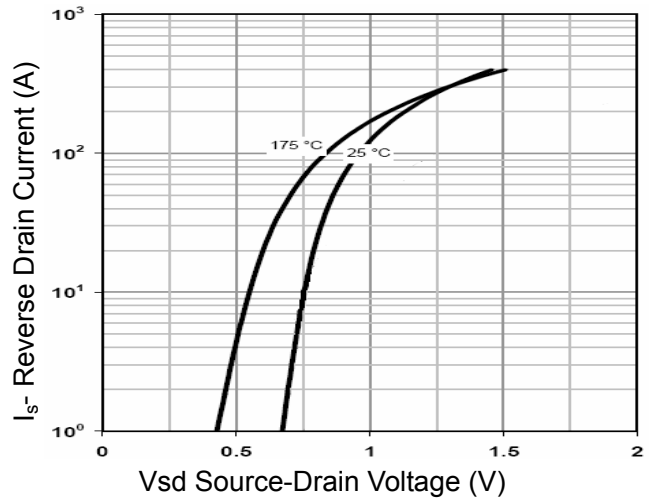


Figure 6 Source- Drain Diode Forward

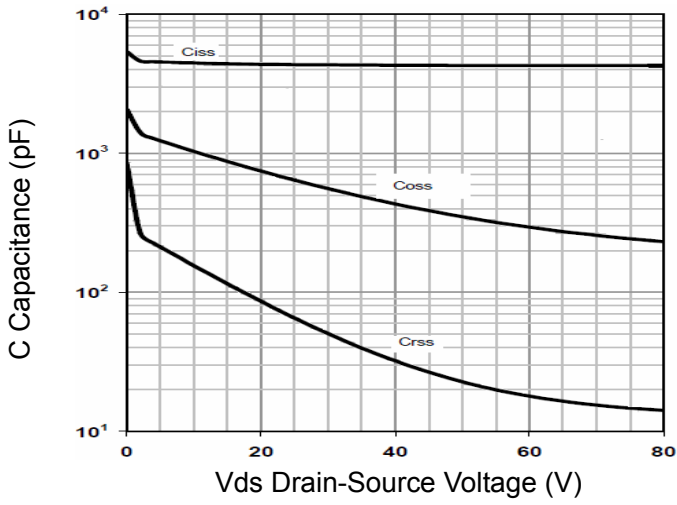


Figure 7 Capacitance vs Vds

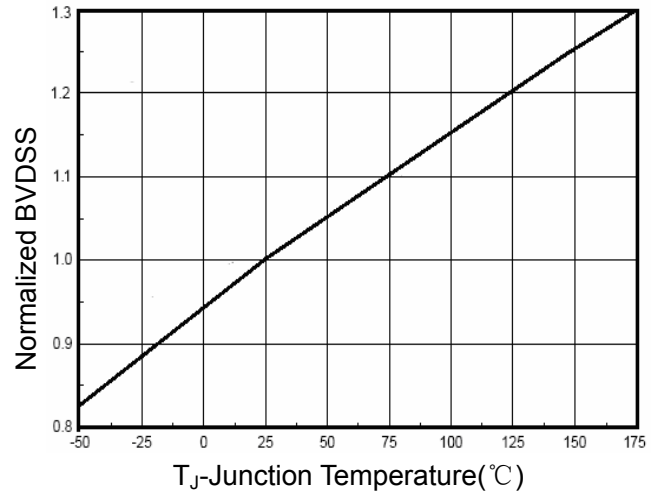


Figure 9 BV_{DSS} vs Junction Temperature

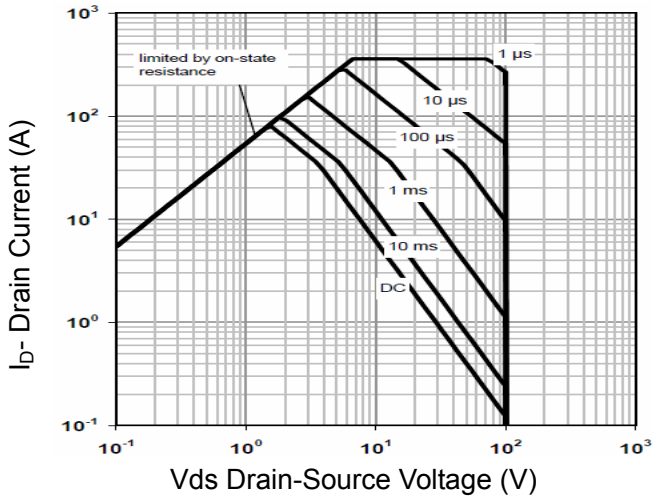


Figure 8 Safe Operation Area

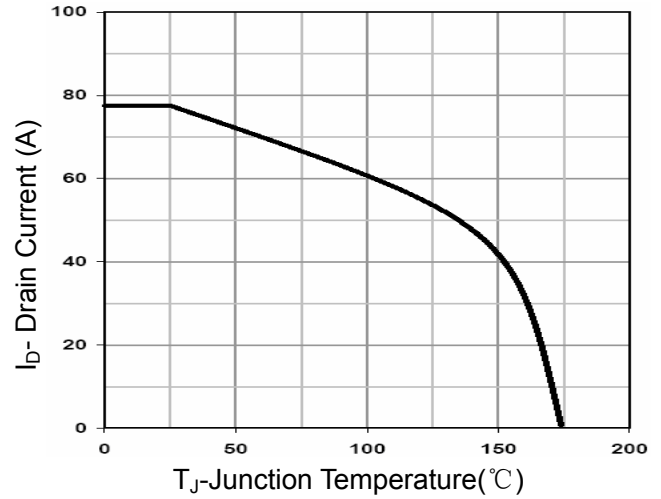


Figure 10 Current De-rating

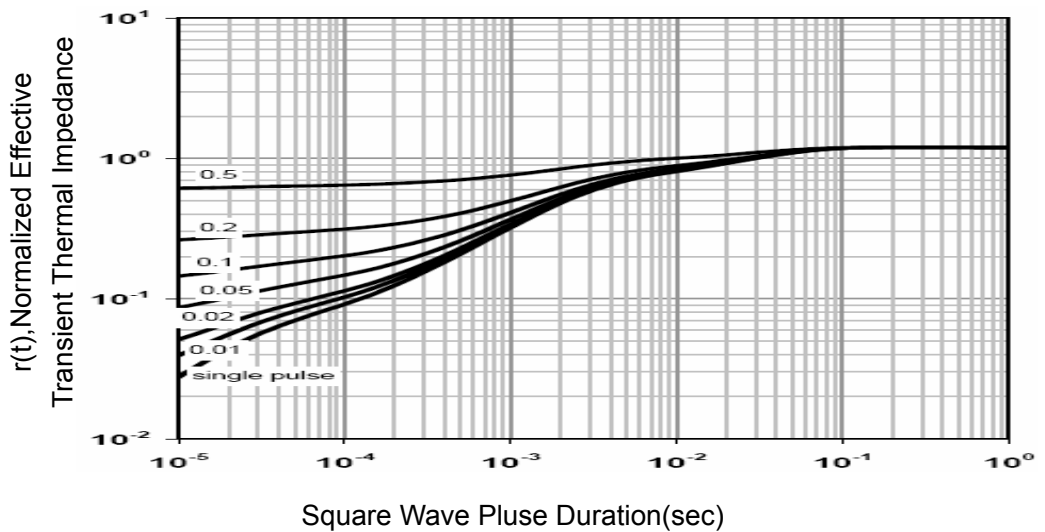
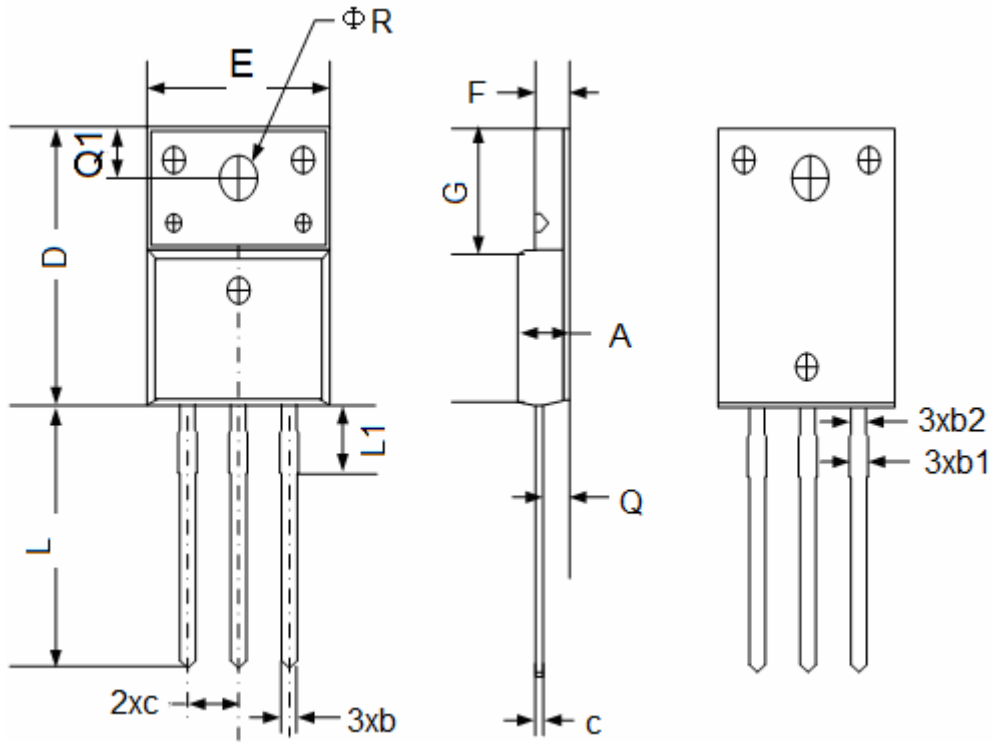


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.50	4.83	0.18	0.19
b	0.70	0.91	0.03	0.04
b1	1.20	1.47	0.05	0.06
b2	1.10	1.38	0.04	0.05
c	0.45	0.63	0.02	0.02
D	15.67	16.07	0.62	0.63
e	2.54 BSC		0.10 BSC	
E	9.96	10.36	0.39	0.41
F	2.34	2.74	0.09	0.11
G	6.48	6.90	0.26	0.27
L	12.68	13.30	0.50	0.52
L1	3.13	3.50	0.12	0.14
Q	2.56	2.93	0.10	0.12
Q1	3.20	3.40	0.13	0.13
ΦR	3.08	3.28	0.12	0.13

Attention

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